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Report by Committee of Enquiry

— INTO —

Motor Fuel and Lubricating Oils in Alberta

PUBLISHED BY ORDER OF THE LEGISLATIVE ASSEMBLY
OF ALBERTA

H. G. L. STRANGE, Fenn, Alberta, Chairman;
JAMES FOWLER, Institute of Technology, Calgary; and
EDGAR STANSFIELD, Research Council of Alberta, Edmonton.

Sessional Paper No. 50, 1931

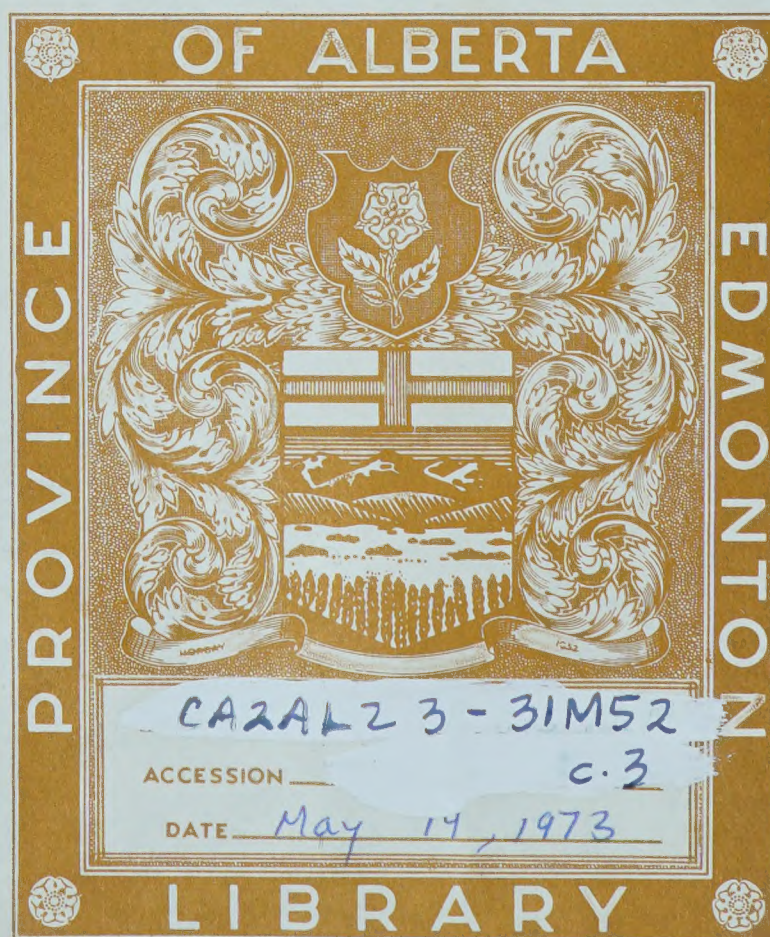
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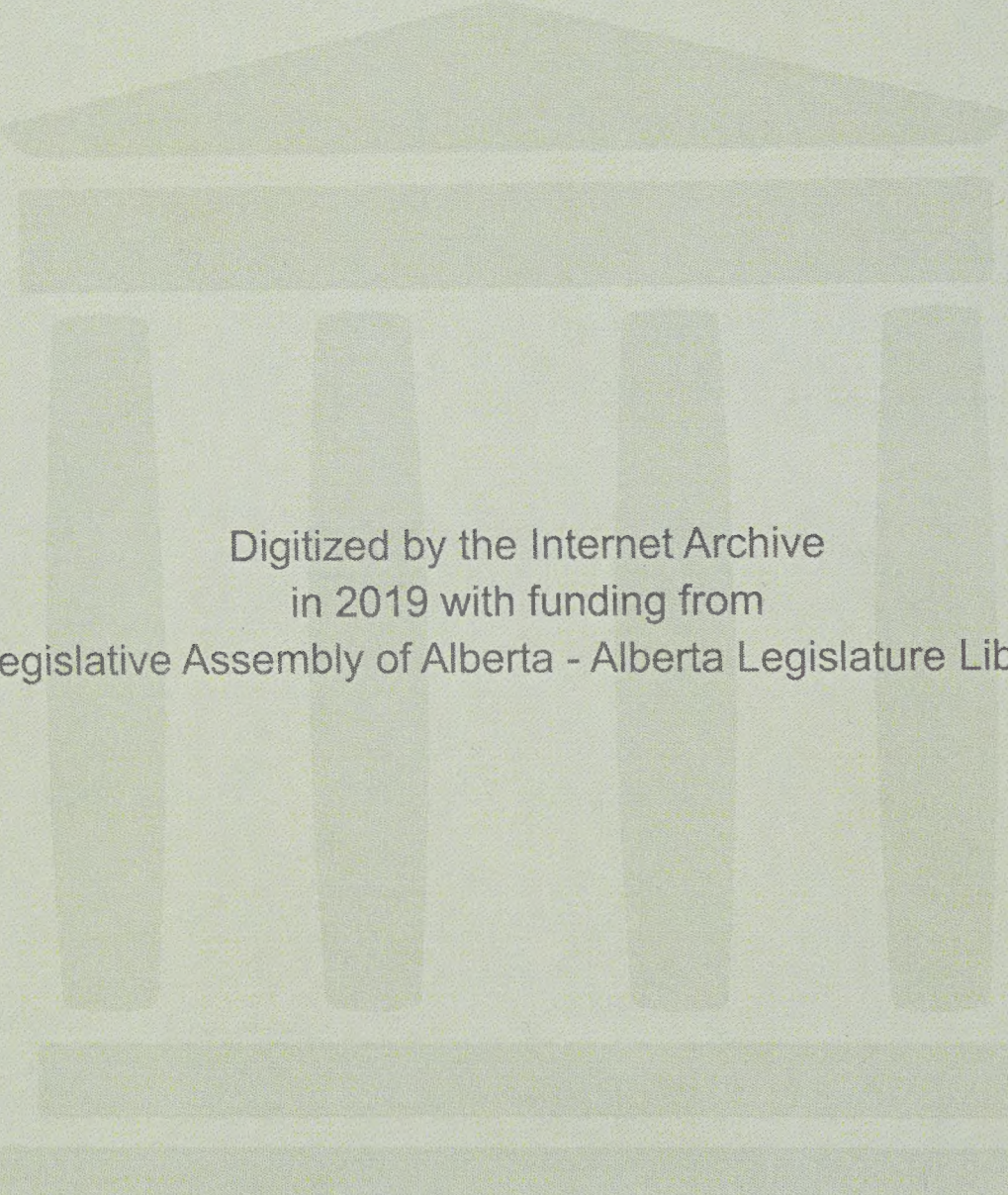
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Appendix I. Results of motor fuel survey in Alberta.

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Note.—Appendix III, IV and V are not included in this Report.

REPORT ON ENQUIRY INTO FUEL AND LUBRICATING OILS IN ALBERTA

This report is submitted by the committee appointed September 6th, 1929, by Order-in-Council 980/29, to enquire into the question raised by the following resolution of the Legislative Assembly: "Resolved, That the Government should conduct an inquiry into the question of the desirability of establishing by law, standards and grades for all fuel oils and lubricating oils used in internal combustion engines; and that the Government report the result of such inquiry to the next session of this Assembly."

The committee at an early stage of its investigations decided that the advantages sought to be gained by establishing standards and grades included guidance to the purchaser, improvement in quality and uniformity of delivery, and prevention of substitution or adulteration; that is, in brief, the guarantee to the purchaser of a better return for his money. They further decided that satisfactory standards would have to be broad enough, and of such a nature, that the industries of production, distribution, sale and delivery to the ultimate consumer would not be hampered to any serious extent, and the price of the product thereby raised. The committee recognized that the satisfactory establishment of standards presupposed the possibility of determining and standardizing quality by means of definite tests of ready applicability. The investigations of the committee were based primarily on the above interpretation of the question presented for its consideration.

INVESTIGATIONS

The committee sent a questionnaire to the Secretaries of the U.F.A. Locals throughout the Province, asking for information on brands and grades of oil offered for sale in each district, together with the experiences of farmers with these oils in different makes of tractors and under different conditions of use. A large number of replies were received, and the information thus gained was used when planning the later investigations.

In order to study the questions of quality, uniformity, substitution and adulteration of the oil products marketed, two surveys were made. The first of a comprehensive range of brands and grades of motor fuel and lubricating oil samples obtained directly from the manufacturers or wholesalers operating in the Province. The second, a similar survey, but of samples obtained from ultimate consumers in eight separate sections of the Province.

In the first survey 20 motor fuel and 138 lubricating oil samples were collected, and in the second survey 36 motor fuel and 74 lubricating oils. In addition 7 lubricating oils were received from middlemen. A total of approximately 3400 tests, including duplicate tests, was made on these samples. These tests included gravity, flash, sulphur content, acidity, and distillation range for motor fuels, and gravity, pour-point, carbon residue, flash and fire

points, and viscosity for lubricating oils. A full report on the results of the tests on motor fuels is given in Appendix I, and on the results of the tests on lubricating oils in Appendix II. These reports give a mass of technical detail fully intelligible only to the expert, but the general conclusions drawn from them are given in a later section of the main report. An attempt was made to present the results of tests of motor fuels and lubricating oils in a graphical manner which would make more apparent the similarities and differences of the products tested. A few examples of such graphs were given in Appendix III. In the same appendix a further graphical study was made of the change of viscosity of lubricating oils with temperature.

The Fuels Division of the Department of Mines at Ottawa conducts an annual summer survey of the gasoline sold in the Dominion. At the request of this committee, it carried out an extensive winter survey in 1930 on the gasolines, kerosenes, and miscellaneous motor fuels sold in Alberta. These motor fuel samples represented the principal brands and grades sold; they were collected from distributors in Calgary, Edmonton, Lethbridge, Medicine Hat and Red Deer, and amounted to a total of 122. The results of this survey were fully reported, with comments, by Messrs. P. V. Rosewarne and H. McD. Chantler in Memorandum Series No. 42 of the Mines Branch, Department of Mines, Ottawa. The comments on the quality of product marketed were, on the whole, distinctly favourable. It should be pointed out that the committee collected samples of motor fuels from wholesalers and from consumers, whilst in the Ottawa survey the samples were collected from the local distributors. The three surveys are therefore supplementary.

A few series of tractor-running tests were made in the tractor department of the Institute of Technology at Calgary, under the supervision of Mr. T. A. Hedley, the Head of the Department.

The first series of tests was planned to ascertain the dilution of lubricating oil which occurs in normal operation at different loads, and more particularly during starting. The second series was to determine the minimum percentage of dilution which results in failure of the oil to satisfactorily lubricate. The third series was a prolonged run using diluted oil to ascertain the wear on the moving parts and any resulting loss in power of the engine. The fourth series to ascertain the consumption of lubricating oil in prolonged running of tractor engines in new, fair and poor condition. In all the series, except the third, duplicate tests were made with equivalent grades of two well-known brands of tractor oil.

One series of field tractor tests was made for the committee by the Brothers Barkley of Spring Bank, near Calgary, in an effort to ascertain the consumption of oil, and dilution occurring, under actual operative conditions. These tests were also made in duplicate with the same two oils.

The Fuels Division of the Department of Mines has supervised an extensive series of field tractor tests in the vicinity of Ottawa, but the results of this work have not yet been received.

SUMMARY OF INFORMATION COLLECTED AND RESULTS OBTAINED

Questionnaire.

The replies to the questionnaire submitted to the U.F.A. Locals through their central office showed some complaints with regard to occasional occurrences of water in gasoline and kerosene. More general dissatisfaction was indicated with respect to lubricants. A study of the replies, however, showed that certain well-known brands of lubricants gave satisfaction to some users and gave cause for dissatisfaction to others. With some brands the only complaints were with respect to price.

Uniformity, Substitution and Adulteration.

Comparison of the results of tests of the samples supplied by the manufacturers or wholesalers with the results of tests of samples secured from consumers, indicates as follows: (A) with gasoline samples there was a distinct variation, but this was merely due to the customary change from winter to summer specifications, a change essential for satisfactory operation. (B) With kerosenes no seasonal variations are necessary and few significant differences were found. (C) With lubricating oils the comparisons on the whole were strikingly good. This is the more surprising when it is remembered that some of the samples compared were obtained a year and a half apart, and when the possibilities of erroneous naming by the consumer are recognized. A few cases were noted where the sample obtained from the consumer was quite different from, although not necessarily worse than, any of the samples supplied by the manufacturer of the brand named. It is significant that in every case such brands were products of small manufacturers; but in justice to small manufacturers in general it should be stated that comparison of the samples obtained directly and indirectly from other small manufacturers showed commendable uniformity.

Substitution of brands was never encountered, unless the few cases of discrepancies noted above were due to this cause. The same, however, cannot be said with respect to grades. In a number of cases a sample quoted as "extra heavy" for example, by the consumer was found to be obviously the "special heavy" or other grade of the manufacturer. This type of error was associated with the above kind of confusing nomenclature; there was no evidence of deliberate substitution. No adulteration was detected in any of the 275 samples tested.

Quality of Motor Fuels.

Gasoline quality in general was distinctly good, and the volatility was greater than the requirements of the United States Government. The sulphur content in general was quite satisfactory, although in a few samples a trivial excess was noted. The sample received from one manufacturer contained an unusually high percentage of extremely volatile constituents, due apparently to insufficient care with the blending of casing head gasoline; four samples, received directly or indirectly from the same manufacturer, contained free acid, an unnecessary and undesirable feature.

Kerosene qualities in general were good also, although it must be reported that one sample received from a manufacturer, had a flash point below normal room temperature. Another sample of motor fuel also had a low flash point, but this sample was marketed as a distillate and should not be classed with the kerosenes, although resembling them in most features. This low flash point increases its value as a motor fuel but warning should be given against the use of such material in kerosene lamps. A third sample, in this case from an unidentified source, also had a low flash point. No gasoline or kerosene samples contained any water.

In short, the committee found little reason to recommend change leading to control of quality of supply of motor fuels sold in the Province, and inclines to the belief that legal restrictions would be costly to enforce and more likely to lead to increased cost to the consumer than to improvement of quality.

Quality of Lubricating Oils.

The standard tests were carried out on all samples. No facts were noted which would indicate that any sample was an unsatisfactory lubricant, but it must be recognized that present day opinion does not regard such tests as determining the lubricating quality of oils.

These standard tests are carried out to facilitate the identification of an oil, and as a check on the uniformity of successive consignments; the viscosity determinations, moreover, indicate the suitability of the oil for a particular use. Viscosity is a good measure of the consistency or body of an oil, but it must be remembered that it does not measure the effective lubricating value or lasting quality of the oil.

The work shows that a bewildering choice of liquid lubricants, of almost every possible viscosity, is available in the Province.

The mineral oils commonly employed as lubricants are of three different types, known respectively as paraffin base, naphthene base and mixed base oils, and these types are distinguishable by small differences of test results. The paraffin base oils were found to show smaller changes in viscosity with increase of temperature than do the naphthene base oils. It is recognized that, *other things being equal*, the smaller the change of viscosity with a given change of temperature, the better the oil; but, unfortunately, it is not yet possible to state definitely as between two oils *that other things are equal*. In other words, other and possibly unrecognized qualities may, in practice, have an important bearing on the lubricating value of an oil. In one well known quality, for example, that of pour-point, the naphthene base oils are superior to the paraffin base oils of similar grades.

The grading of lubricating oils was found to be extremely unsatisfactory. If there were only a few brands of oils and only a few grades of each brand, it would be comparatively simple to exhaustively test each oil and to tabulate the results. As a matter of fact 34 brands of oil were collected and the separate grades of a

single brand rose as high as 11. Approximately 150 varieties were tested. The consumer is thus faced with a bewildering task in making a selection.

The situation is rendered far worse by extreme confusion in the naming of the grades. One small group of oils of almost identical viscosity were named respectively as zero, winter light, light winter, winter, motor light, light and No. 111. Another similar group of higher viscosity were named light, cold test, medium and No. 112. A third group of still higher viscosity were named medium heavy, heavy and extra heavy. In some brands the letters A, B, C, etc., denote oils of successively increasing viscosity, in other brands the reverse is the case.

Some manufacturers label their oils solely, or in addition to their regular grade name, by the viscosity numbers recommended by the Society of Automotive Engineers to describe certain specified ranges of viscosity. These viscosity numbers are S.A.E. 10, S.A.E. 20, etc. up to S.A.E. 60, arranged in order of increasing viscosity. This authority therefore recognizes that, as far as viscosity is concerned, all ordinary needs of motor lubrication could be met by the supply of not more than six grades of oil.

The committee entirely failed to find tests of quality on which legally enforceable standards could be based.

Tractor Tests.

The tractor tests showed that dilution of the lubricating oil is not serious during periods of steady running. More serious dilution may occur temporarily through excessive use of the choke in repeated attempts to start the engine. The unburned gasoline condensing on the walls of the cylinders may wash down the usual film of lubricating oil with consequent lack of lubrication at the start of operation.

No failure of lubrication was noted even when the regular oil supplied was pre-diluted with four times its volume of kerosene. The consumption of oil, and therefore the cost of lubrication, however, was notably increased with such dilution. The power obtainable with the engine was not perceptibly reduced even after 60 hours of steady operation, under load, when supplied with such pre-diluted oil.

Tests on the consumption of oil with engines in poor, fair, and new condition, showed consumption for 8 hours of operation, of about $3\frac{1}{2}$, $2\frac{1}{2}$ and $1\frac{1}{2}$ quarts respectively. The new engine rapidly decreased in oil consumption as it was run in, and after 120 hours operation the consumption during an 8 hour run was almost negligible.

No significant difference was found either in these series of tests or in the field tests between the two brands of oils employed. The field tests also confirmed the earlier tests in showing negligible dilution during steady operation, and increased oil consumption with increased wear of the engine.

ACKNOWLEDGMENTS

The committee desires to acknowledge its indebtedness to the following for assistance in its work:—

The Hon. R. G. Reid for helpful guidance throughout the investigation.

The Department of Mines at Ottawa, and particularly Mr. P. V. Rosewarne, engineer in charge of the oil and natural gas section of the Division of Fuels and Fuel Testing, for co-operation and assistance in many phases of work.

The National Research Council for taking an active interest.

The U. F. A. organization for its help in distributing questionnaires to each of its Locals, and to the secretaries of these Locals for supplying much valuable information.

The oil and the tractor industries, not only for the interest they took, but also for the valuable data, information, specifications, and samples of oils, etc., they have supplied to the committee.

Mr. T. A. Hedley, of the tractor department of the Institute of Technology at Calgary, Professor E. A. Hardy and Professor J. Macgregor Smith of the departments of agricultural engineering at the universities at Saskatoon and Edmonton, and the many other separate workers for valuable information and assistance with respect to the actual operation of tractors, etc. and for information along different lines.

The Barkley brothers, of the Spring Bank district near Calgary, who carried out some field tests on tractors.

The personnel of the Provincial Department of Agriculture who arranged for and assisted in the collection of oil samples in many parts of the Province.

The Provincial Institute of Technology at Calgary, which provided laboratory accommodation and the free use of apparatus, as well as tractors and tractor-testing equipment. The Research Council of Alberta, which assisted with some tests, and took charge of the accounting and clerical division of the investigation.

CONCLUSIONS AND RECOMMENDATIONS

The committee as a result of its tests and investigations, its study of available information with respect to tests and researches by other bodies, and its review of standards, and specifications, and legislation in other countries, have come to the unanimous conclusion that it is not desirable to establish by law standards and grades for fuel oils, and that it is not practicable, and therefore not desirable, to establish by law standards and grades for lubricating oils to be used in internal combustion engines.

Whilst the committee has felt compelled to answer in the negative the specific enquiry it was appointed to consider, the committee do feel that the conditions with respect to the supply and use of motor fuel and lubricating oils in the Province might be improved. It respectfully submits for consideration the following suggestions:

1. That legislation, at the present time, should not go further than an anti-substitution law to restrict the supply by the vendor of a brand or grade of fuel or lubricating oil other than that which the purchaser has reason to believe that he is receiving.

2. That for the control and enforcement of such an anti-substitution law the different oil manufacturers or wholesalers operating in the Province should be required to deposit with the Government specifications and tolerances for any brands and grades of oils they are marketing. Such regulations with regard to specifications should be framed not to restrict the natural improvement to be expected in the products sold; but with the proviso that modified specifications must be supplied when any noteworthy change is made.

3. That ample laboratory facilities shall be available in the Province for the testing of fuel and lubricating oils.

4. That, in view of the present confusion with respect to the different names given for the same grade of oil by the several manufacturers, all manufacturers of lubricating oils should be encouraged to mark on containers the S.A.E. number for the viscosity of the oil, and that consumers should familiarize themselves with the S.A.E. numbers of the lubricating oils suited to their needs and should insist on knowing the S.A.E. number of their purchases.

5. That steps should be taken to bring to the attention of operators and owners of tractors, trucks and automobiles, the salient features of the choice, and correct use, of fuel and lubricating oils. Such dissemination of information could be arranged through the tractor schools, and by pamphlets and by other recognized methods. The committee suggests that use might be made of the memorandum of the Mines Branch at Ottawa, prepared by Mr. P. V. Rosewarne on the subject of lubricant and lubrication. The committee has attached as Appendix VI to this report a collection of the more important facts with regard to fuel oils and lubrication which have been impressed upon it during the course of its investigations.

6. That continued research on oils and lubrication should be encouraged in Alberta and the other Provinces, as well as in Ottawa. The committee feels strongly that such research in Alberta is valuable for the discoveries made, but is even more valuable for the advantage of having in the Province at least one trained man who is necessarily interested in, and familiar with, the latest developments of the science and art of lubrication, and who is available to advise farmers and others on their lubrication problems.

7. That in order to maintain efficiency and conserve effort in such research, the National Research Council should be asked to co-ordinate and extend such work throughout the Dominion.

8. That the Research Council of Alberta should be instructed to take charge of any further Provincial research along these lines, and to cooperate with any national scheme as proposed in section 7.

9. That this report be received and the committee discharged.

APPENDIX I.

Results of Motor Fuel Survey in Alberta

This survey covered tests of two types of samples. The first included 20 motor fuel samples, numbered 201-220, obtained directly from the manufacturer or wholesaler. The second included 36 motor fuel samples, numbered 301-336, obtained from consumers in eight separate sections of the province.

The following report gives the results on these samples, grouped under the manufacturer or refiner. The report shows the brand, the grade and the following distillation results:—the temperature at the initial boiling point, the temperatures recorded when 5%, 10%, 20%, 50%, 90% and 95% of the liquid has distilled over and been collected in the receiving vessel, and the temperature at the final boiling point—all in Fahrenheit degrees—as well as the total percentage of the liquid recovered in the receiving vessel. The report also gives the density of the liquid at 60°F, in degrees A.P.I. (American Petroleum Institute) for those who are familiar with that system and in pounds per Imperial gallon for others, the percentage of sulphur, and the flash point in degrees Fahrenheit. No flash point is given for gasoline samples, as these all flash, that is, the vapours fire or explode when a flame is brought near, at temperatures even below ordinary room temperatures. The residue left after distillation was tested for acidity, and the presence or absence of acidity noted.

O.C. No.	Brand	Grade	Initial Boiling Pt. °F	5 % over at °F	10 % over at °F	20 % over at °F	50 % over at °F	90 % over at °F	95 % over at °F	Final Boiling Pt. °F	Recovery %	Density at 60° F. A. P. I.	lbs./gal.	Sulphur %	Flash Point °F	Free Acid
209	North Star	High Life Gas (Aviation)	92	109	113	120	148	237	280	320	97.0	76.2	6.81	.013	....	Nil
210	North Star	Ethyl Gasoline	94	125	141	175	250	370	409	422	96.8	60.3	7.38	.106	....	Nil
211	North Star	Gasoline	89	119	136	165	240	370	409	419	96.5	62.3	7.30	.105	....	Nil
306	North Star	Gasoline	102	134	148	178	246	365	401	421	98	60.4	7.37	.099	....	Nil
313	North Star	Gasoline	107	136	154	181	249	370	397	423	98	59.5	7.41	.106	....	Nil
330	North Star	Gasoline	129	165	182	203	262	372	401	424	98.4	56.5	7.53	.091	....	Nil
212	North Star	Keystone Kerosene	169	343	368	392	419	461	474	492	98.5	43.0	8.11	.093	Below 68	Nil
213	North Star	White Star Kerosene	353	363	365	374	401	447	469	487	98.5	42.8	8.12	.036	122	Nil
302	North Star	Kerosene	356	374	383	392	414	455	469	484	98.3	42.9	8.12	.110	120	Nil
309	North Star	Kerosene	369	384	392	399	416	457	473	480	98	41.9	8.16	.032	131	Nil
311	North Star	Kerosene	349	380	387	397	419	462	475	492	98	41.8	8.16	.090	142	Nil
327	North Star	Kerosene	366	378	381	388	410	461	477	497	98.3	42.2	8.15	.052	133	Nil
220	Keystone	Kerosene	205	393	384	397	419	457	469	482	98.3	41.6	8.17	.122	139	Nil
214	Br. American	Gasoline (Super Power)	90	116	130	155	214	352	402	412	97.0	64.9	7.21	.126	....	Nil
308	Super Power Br. American	Gasoline	109	136	153	179	248	370	406	424	97.8	59.5	7.41	.105	....	Nil
318	Br. American	Gasoline	100	134	151	180	248	365	396	424	98	59.0	7.41	.106	....	Nil
323	Br. American	Gasoline (Super Power)	99	129	149	178	247	367	400	421	98	60.0	7.39	.093	....	Nil
331	Br. American	Gasoline	94	128	147	176	252	378	412	423	97.3	60.1	7.31	.105	....	Nil
215	Br. American	Kerosene	372	387	390	397	417	457	462	481	98.0	41.8	8.16	.117	139	Nil
305	Power Life Br. American	Kerosene	374	386	391	396	410	453	470	488	98.3	42.0	8.16	.027	143	Nil
319	Br. American	Kerosene	337	364	381	394	415	459	475	496	98.3	42.0	8.16	.090	111	Nil
216	Imperial	Gasoline	94	126	142	168	232	367	399	419	98.0	61.9	7.32	.115	....	Nil
303	Imperial	Gasoline	112	147	163	185	252	365	392	419	98	59.2	7.43	.093	....	Nil
312	Premier	Gasoline	107	140	159	185	253	372	403	427	98	59.0	7.43	.106	....	Nil
316	Imperial	Gasoline	101	131	150	176	247	372	397	423	98	61.1	7.35	.111	....	Nil
324	Premier	Gasoline	100	133	151	179	250	372	402	423	98	59.7	7.40	.109	....	Nil
325	Premier	Gasoline	98	132	151	179	246	364	397	421	98	60.2	7.38	.125	....	Nil
328	Premier	Gasoline	101	140	158	191	261	360	388	406	98	56.7	7.52	.104	....	Nil
332	Imperial	Gasoline	100	129	149	178	268	369	401	424	98	59.9	7.39	.105	....	Nil
217	Imperial	Kerosene	368	380	387	395	415	455	469	486	98.5	41.7	8.17	.106	131	Nil
314	Royalite	Kerosene	361	378	384	401	419	455	473	492	98.3	41.6	8.17	.097	139	Nil
315	Imperial	Kerosene	370	380	383	388	408	458	475	496	98	42.3	8.15	.007	134	Nil
320	Royalite	Kerosene	361	379	385	394	415	459	471	487	98	41.7	8.17	.110	136	Nil
321	Imperial	Kerosene	364	379	385	396	417	459	471	487	98	41.8	8.16	.115	138	Nil
326	Imperial	Kerosene	331	366	376	387	408	462	480	496	98	42.6	8.13	.003	89	Nil
329	Imperial	Kerosene	361	376	378	383	403	453	469	486	98	42.6	8.13	.011	127	Nil
334	Imperial	Kerosene	370	383	388	396	412	459	478	497	98.3	42.2	8.15	.036	129	Nil
218	Regal	Gasoline	78	96	109	127	183	370	...	...	91.0	72.6	6.93	.121	....	Yes
304	Regal	Gasoline	109	132	145	165	216	344	386	424	97.8	63.4	7.26	.106	....	Yes
310	Regal	Gasoline	96	125	140	167	233	377	410	430	98	61.7	7.32	.123	....	Nil
317	Regal	Gasoline	109	140	153	171	217	347	387	415	98	62.2	7.30	.116	....	Yes
336	Regal	Gasoline	103	135	149	173	237	354	396	417	98	61.4	7.33	.103	....	Yes
219	Regal	Kerosene	331	359	365	374	405	457	471	494	98.5	42.2	8.15	.135	106	Nil
307	Regal	Kerosene	345	363	375	385	406	443	459	477	98.3	41.9	8.16	.116	121	Nil
333	Regal	Kerosene	316	354	367	383	414	466	484	507	98	42.4	8.14	.079	109	Nil

APPENDIX II.

Results of Lubricating Oil Survey in Alberta.

This survey covered tests of three types of samples. The first included 138 samples, numbered 1-138, obtained directly from the manufacturer or wholesaler. The second included 7 samples, numbered 401-407, obtained from retailers. The third included 74 samples, numbered 801-874, obtained from consumers in different districts. These three types of samples are elsewhere referred to as A, B and C respectively.

The following report gives the results on these samples, grouped under the manufacturer or refiner. The report shows the brand and the grade, the density at 60°F in degrees A.P.I. (American Petroleum Institute) and in pounds per Imperial gallon, the flash point and fire point in degrees Fahrenheit, the pour point or temperature at which the oil becomes sufficiently liquid to pour under the conditions of the test, and the carbon residue percentage or amount of carbon residue left when the oil is evaporated off under certain specified conditions. The report also shows the viscosity of the oils, expressed as the time in seconds a definite amount of the sample takes to flow from a Saybolt Universal Viscosimeter at one or more of the three temperatures 100°F, 130°F and 210°F.

O.C. No.	Brand	Grade	Density at 60 °F.		Flash Point in deg. F.	Fire Point in deg. F.	Pour Point in deg. F.	Carbon residue in %	Visc. at 100° F.	Visc. at 130° F.	Visc. at 210° F.
			A.P.I.	lbs./gal.							
1	P.O.D.R.	S.A.E. 10	25.1	9.04	410	465	20	.282	259	145	....
2	P.O.D.R.	S.A.E. 20	25.0	9.04	415	475	20	.394	418	185	....
3	P.O.D.R.	S.A.E. 30	25.0	9.04	420	485	20	.497	480	213	....
4	P.O.D.R.	S.A.E. 40	25.0	9.04	430	485	20	.716	....	....	72
5	P.O.D.R.	S.A.E. 50	24.8	9.06	460	515	20	.933	....	....	99
812	P.O.D.R. (Superb)	Medium Tractor	24.2	9.09	435	510	Below 20	.860	....	....	95
864	Richol	Medium	24.3	9.09	435	495	" 20	.808	....	....	93
6	P.O.D.R.	S.A.E. 60	24.8	9.06	470	535	20	1.027	....	....	109
7	Rockol	Motor Light	20.4	9.33	370	390	Below 20	.058	217	100	....
8	Rockol	Motor Medium	19.4	9.38	375	395	" 20	.090	371	151	....
9	Rockol	Motor Heavy	19.1	9.39	390	425	" 20	.141	596	222	....
10	Rockol	Tractor Medium	20.2	9.33	410	450	" 20	1.308	....	....	85
11	Rockol	Tractor Heavy	20.7	9.30	410	460	" 20	1.403	....	....	97
12	Rockol	Tractor Extra Heavy	22.7	9.18	540	605	20	2.491	....	....	155
872	Rockol	Tractor B	24.7	9.06	430	510	30	.931	....	....	74
13	Empress	Medium	27.8	8.88	455	505	40	1.101	....	384	86
14	Empress	Heavy	26.7	8.94	520	595	45	1.450	....	....	138
15	Argyle Mogul	Medium	28.0	8.87	440	495	40	.886	....	....	80
16	Argyle Mogul	Heavy	22.1	9.21	510	590	30	1.828	....	....	161
811	C. C. Snowdon	Extra Heavy Tractor	24.8	9.05	445	525	Below 20	1.500	....	....	120
17	Texaco	Motor Medium	20.5	9.31	365	410	" 20	.029	325	141	....
18	Texaco	Motor Heavy	19.6	9.36	380	430	" 20	.047	538	209	....
824	Texalube	Medium Heavy	19.9	9.34	Contains water	430	" 20	.044	....	206	53
19	Texaco	Motor Extra Heavy	19.2	9.39	390	450	" 20	.060	....	292	60
20	Texaco	Super Heavy	19.0	9.40	435	495	" 20	.110	....	585	83
21	Texaco	Bus X	21.5	9.25	400	440	" 20	.328	....	299	66
22	Texaco	Bus XX	22.5	9.19	425	490	" 20	.825	....	....	95
805	Texaco	Extra Heavy	19.2	9.39	390	450	" 20	.062	....	....	95
806	Texaco	Bus XX	22.4	9.20	420	485	" 20	.824	....	....	93
857	Texaco	Medium	22.1	9.21	425	485	" 20	.762	....	....	93
23	Texaco	Bus XXX	23.0	9.16	460	540	" 20	1.720	....	....	124
24	Texaco	Tractor C	23.4	9.14	390	440	25	1.160	....	....	75
807	Texaco	Tractor C	23.2	9.15	375	430	35	1.220	....	....	71
25	Texaco	Tractor B	23.7	9.12	430	505	35	1.721	....	....	114
26	Texaco	Tractor A	24.0	9.10	500	585	45	2.155	....	....	146
81	Texaco	Light	20.8	9.29	340	380	Below 20	.018	224	105	....
27	Veedol	Light Zero	21.0	9.28	340	385	" 20	.105	242	114	....
28	Veedol	Winter Medium	24.4	9.08	420	485	" 20	.132	347	158	....
29	Veedol	Medium	25.0	9.04	435	500	30	.483	486	211	....
30	Veedol	Heavy	....	....	445	510	30	.812	....	327	74
31	Veedol	Extra Heavy	25.4	9.02	480	545	30	1.325	....	585	107
32	Veedol	Forzol Zero	21.9	9.22	340	380	Below 20	.077	216	110	....
33	Veedol	Forzol	24.7	9.06	420	480	40	.141	299	141	....
34	Noroco	Winter Light	23.5	9.13	365	415	Below 20	.030	215	106	....
35	Noroco	Light	21.7	9.24	380	440	" 20	.092	322	143	....

O.C. No.	Brand	Grade	Density at 60° F.		Flash Point in deg. F.	Fire Point in deg. F.	Pour Point in deg. F.	Carbon Residue in %	Visc. at 100° F.	Visc. at 130° F.	Visc. at 210° F.
			A.P.I.	lbs./gal.							
36	Noroco.....	Medium.....	19.1	9.39	380	440	Below 20	.042	....	265	58
37	Noroco.....	Heavy.....	18.4	9.44	400	460	" 20	.061	....	416	67
38	Noroco.....	Tractor B.....	17.6	9.49	435	505	" 20	.400	....	....	108
39	Noroco.....	Tractor C.....	17.3	9.51	440	520	" 20	.461	....	....	123
40	Enarco.....	Light Winter.....	....	....	360	410	" 20	.062	207	101	....
41	Enarco.....	Medium.....	25.0	9.04	390	450	40	.463	301	144	....
42	Enarco.....	Extra Medium.....	24.9	9.05	395	460	40	.645	184	184	....
43	Enarco.....	Heavy.....	24.4	9.08	405	465	45	.968	256	256	65
44	Enarco.....	Extra Heavy.....	23.0	9.16	445	520	50	1.601	....	....	102
45	Enarco.....	Special Heavy.....	23.1	9.15	425	495	45	1.763	....	....	92
46	Velvet.....	Light Cold Test.....	21.5	9.25	375	425	Below 20	.091	263	123	....
47	Velvet.....	Light.....	26.1	8.97	405	470	" 20	.328	292	139	....
48	Velvet.....	Medium Cold Test.....	21.7	9.24	390	435	" 20	.440	395	174	....
49	Velvet.....	Medium.....	25.7	9.00	410	470	" 20	.530	377	174	....
50	Velvet.....	Medium Heavy.....	....	....	420	480	" 20	.866	514	231	....
51	Velvet.....	Heavy.....	24.9	9.05	430	490	" 20	1.239	....	325	75
52	Velvet.....	Heavy Tractor.....	24.7	9.06	445	500	" 20	1.362	....	....	77
53	Velvet.....	Medium Extra Heavy Tractor.....	24.6	9.06	450	505	" 20	1.370	....	....	85
54	Velvet.....	Extra Heavy Tractor.....	24.0	9.10	455	515	" 20	1.635	....	....	97
55	Velvet.....	Super Heavy Tractor.....	24.0	9.10	455	520	" 20	1.814	....	....	108
56	Mobiloil.....	E for Fords.....	23.8	9.11	365	420	" 20	.084	244	117	....
861	Mobiloil.....	Arctic.....	23.1	9.15	370	415	" 20	.086	....	123	47
57	Mobiloil.....	A-Heavy Medium.....	24.9	9.05	380	440	" 20	.070	246	119	....
58	Mobiloil.....	A (S.A.E. 30).....	22.8	9.17	405	475	" 20	.221	625	252	61
835	Mobiloil.....	A.....	22.7	9.18	405	470	" 20	.245	....	....	61
847	Mobiloil.....	A.....	22.6	9.18	405	465	" 20	.296	....	....	61
854	Mobiloil.....	A.....	22.9	9.17	410	475	" 20	.334	....	....	61
855	Mobiloil.....	A.....	23.6	9.12	415	475	" 20	.741	....	....	66
862	Mobiloil.....	A.....	23.2	9.15	425	495	" 45	.498	....	234	66
59	Mobiloil.....	BB-Medium Heavy.....	25.5	9.01	450	510	30	.765	....	319	61
836	Mobiloil.....	BB (S.A.E. 40).....	24.7	9.06	435	490	30	1.08	....	....	74
859	Mobiloil.....	BB.....	24.7	9.06	435	500	30	1.02	....	....	74
874	Mobiloil.....	BB.....	24.9	9.05	445	505	30	1.11	....	....	73
60	Mobiloil.....	B Extra Heavy.....	25.9	8.99	475	545	45	1.076	760	495	97
853	Mobiloil.....	B.....	23.9	9.11	460	530	30	1.50	....	....	99
134	Mobiloil.....	A F.....	24.3	9.08	420	480	Below 20	.752	....	279	66
860	Mobiloil.....	A F.....	22.9	9.17	410	465	" 20	.341	....	250	60
61	Marvelube.....	F for Fords.....	23.0	9.16	365	425	" 20	.089	415	176	....
62	Marvelube.....	Light Medium.....	24.0	9.10	360	420	" 20	.024	252	117	....
63	Marvelube.....	Medium.....	23.0	9.16	355	400	" 20	.037	309	140	....
64	Marvelube.....	Heavy.....	22.2	9.21	385	440	" 20	.098	....	252	59
802	Marvelube.....	Heavy (S.A.E. 30).....	22.2	9.21	390	445	" 20	.105	....	....	58
845	Marvelube.....	Heavy.....	22.2	9.21	385	445	" 20	.070	....	....	61
850	Marvelube.....	Heavy.....	22.3	9.20	390	450	" 20	.112	....	....	61
65	Marvelube.....	Special Heavy.....	21.6	9.24	420	485	" 20	.141	1198	415	73

O.C. No.	Brand	Grade	Density at 60° F.		Flash Point in deg. F.	Fire Point in deg. F.	Pour Point in deg. F.	Carbon Residue in %	Visc. at 100° F.	Visc. at 130° F.	Visc. at 210° F.
			A.P.I.	lbs. gal.							
815	Marvelube.....	Special Heavy (S.A.E. 40).....	21.8	9.23	430	495	Below 20	.116	.....	.....	70
837	Marvelube.....	Special Heavy (S.A.E. 40).....	21.7	9.24	425	495	" 20	.106	.....	.....	71
858	Marvelube.....	Special Heavy.....	21.8	9.23	420	485	" 20	.109	.....	.....	72
66	Marvelube.....	Extra Heavy.....	21.2	9.27	445	520	" 20	.500	.....	722	100
803	Marvelube.....	Extra Heavy.....	21.3	9.26	465	535	" 20	.418	.....	.....	105
813	Marvelube.....	S.A.E. 50.....	21.2	9.27	465	535	" 20	.366	.....	.....	104
816	Marvelube.....	Special Heavy.....	21.1	9.27	450	525	" 20	.321	.....	.....	101
849	Marvelube.....	Heavy.....	21.0	9.28	445	530	" 20	.349	.....	.....	105
871	Marvelube.....	Extra Heavy.....	21.3	9.26	450	535	25	.341	.....	.....	107
68	William Penn.....	Cold Test.....	23.5	9.13	375	415	Below 20	.154	270	127	.....
69	William Penn.....	Light.....	23.5	9.13	370	430	" 20	.065	321	146	.....
827	William Penn.....	Medium.....	25.1	9.03	420	480	30	.581	458	205	.....
804	William Penn.....	Medium Heavy.....	23.4	9.15	405	465	Below 20	.607	.....	.....	64
838	William Penn.....	Medium Heavy (S.A.E. 40).....	23.6	9.08	420	485	35	1.045	.....	316	70
870	William Penn.....	Heavy.....	23.7	9.12	440	510	25	.958	.....	.....	72
814	North Star (Wm. Penn).....	Heavy (S.A.E. 50).....	23.6	9.12	470	540	35	1.656	.....	.....	92
72	William Penn.....	Extra Heavy.....	22.9	9.17	470	525	Below 20	.991	.....	.....	95
869	William Penn.....	Extra Heavy.....	22.9	9.17	475	545	" 20	1.43	.....	.....	94
810	North Star (Wm. Penn).....	Extra Heavy.....	22.4	9.18	500	580	20	1.24	.....	.....	96
73	William Penn.....	Super Heavy.....	22.5	9.19	505	585	25	1.19	.....	.....	131
856	William Penn.....	Medium Light.....	24.5	9.07	355	405	30	2.109	.....	.....	131
74	French.....	Cold Test.....	24.2	9.09	345	390	Below 20	.255	.....	116	159
75	French.....	Light.....	23.5	9.13	380	440	" 20	.030	150	82	47
76	French.....	Medium.....	24.2	9.09	410	470	" 20	.026	307	137	.....
77	French.....	Heavy.....	18.5	9.43	415	485	" 20	.169	452	201	.....
78	Quaker State.....	Cold Test.....	26.4	8.96	360	410	" 20	.085	288	531	80
79	Quaker State.....	Medium.....	28.8	8.83	435	495	25	.219	288	135	48
80	Willoco Wunderlube.....	Heavy.....	26.5	8.95	455	520	30	.420	399	193	58
82	Willoco Wunderlube.....	No. 111.....	21.7	9.24	335	380	Below 20	.851	.....	318	74
83	Willoco Wunderlube.....	No. 112.....	21.5	9.25	360	415	20	.023	214	104	.....
84	Willoco Wunderlube.....	No. 113.....	20.9	9.29	375	435	" 20	.027	316	140	.....
85	Willoco Wunderlube.....	No. 114.....	19.5	9.37	395	460	" 20	.048	522	207	.....
86	Willoco Wunderlube.....	No. 115.....	22.8	9.17	430	500	35	.059	.....	288	63
87	Willoco Wunderlube.....	No. 116.....	22.7	9.18	440	505	35	1.019	.....	293	68
88	Willoco Wunderlube.....	No. 117.....	22.6	9.18	450	515	35	1.279	.....	.....	75
809	Willoco Wunderlube.....	No. 118.....	23.7	9.12	440	510	35	1.435	.....	.....	85
89	Willoco Wunderlube.....	No. 119.....	22.5	9.19	465	535	35	1.58	.....	.....	86
90	Willoco Wunderlube.....	No. 120.....	22.3	9.20	470	545	40	1.744	.....	.....	97
91	Willoco Wunderlube.....	Winter.....	22.2	9.21	480	555	35	2.020	.....	.....	113
92	Neal Bros.....	Medium.....	24.9	9.05	380	455	35	2.386	216	113	131
93	Neal Bros.....	Medium.....	24.3	9.08	415	480	35	.197	300	144	.....

O.C. No.	Brand	Grade	Density at 60 ° F.		Flash Point in deg. F.	Fire Point in deg. F.	Pour Point in deg. F.	Carbon residue in %	Visc. at 100° F.	Visc. at 130° F.	Visc. at 210° F.
			A.P.I.	lbs./gal.							
94	Neal Bros.	Heavy	23.5	9.13	425	500	Below 20	.705	482	216	...
95	Neal Bros.	Special Heavy Tractor	22.6	9.18	435	520	" 20	.489	...	364	73
401	Neal Bros.	Extra Heavy	22.1	9.21	435	520	20	.826	...	349	72
96	Neal Bros.	Extra Heavy	21.8	9.23	460	530	Below 20	.532	...	...	96
405	Neal Bros.	Mobiloil B (so called)	22.0	9.22	475	550	" 20	.845	...	...	117
97	Motul	Medium	28.2	8.86	425	485	35	.600	414	199	60
98	Motul	Heavy	27.7	8.89	440	505	30	.929	640	288	73
99	Motul	Aviation No. 1	28.1	8.86	435	495	30	.699	487	230	63
100	Motul	Aviation No. 2	26.9	8.93	480	555	45	1.322	1455	607	113
101	Autolene	Winter Light	24.2	9.09	355	405	Below 20	.012	173	89	...
102	Autolene	Light	23.0	9.16	375	425	" 20	.014	298	136	...
865	Autolene	Light	23.1	9.15	385	445	" 20	.010	310	135	...
103	Autolene	Medium	22.3	9.20	410	465	" 20	.021	535	218	...
104	Autolene	Heavy	21.7	9.24	425	485	" 20	.047	843	320	65
826	Autolene	Heavy (S.A.E. 40)	21.2	9.27	405	475	" 20	.042	...	...	63
841	Autolene	Sp. Heavy (S.A.E. 40)	21.9	9.22	425	495	" 20	.056	...	...	65
105	Autolene	Special Heavy	23.7	9.12	450	515	25	.914	1005	400	79
825	Autolene	Special Heavy	23.9	9.11	420	485	40	1.49	...	...	87
842	Autolene	Special Heavy (S.A.E. 50)	23.3	9.14	435	490	30	1.56	...	...	88
851	Autolene	Special Heavy	23.7	9.12	430	495	Below 20	1.01	...	...	80
852	Autolene	Special Heavy	23.7	9.12	440	495	30	1.70	...	...	99
867	Autolene	Special Heavy	23.3	9.14	445	505	30	1.40	...	...	90
106	Autolene	Extra Heavy	23.2	9.15	460	520	25	1.601	...	718	112
107	Aristo	Heavy	18.8	9.42	350	405	Below 20	.219	567	213	54
108	Aristo	Special Heavy	18.1	9.46	375	425	" 20	.223	825	291	60
109	Aristo	Extra Heavy	17.6	9.49	375	435	" 20	.264	1010	350	63
110	Aristo	XX Heavy	16.4	9.57	400	460	" 20	.282	2172	608	78
111	Aristo	Ultra Heavy	17.6	9.49	430	500	" 20	.487	3101	865	98
112	Motorite	Medium	19.5	9.37	340	380	" 20	.154	395	153	49
113	Motorite	Heavy	18.8	9.42	355	410	" 20	.168	615	224	54
114	Motorite	Extra Heavy	17.3	9.51	380	440	" 20	.290	1224	390	65
115	Motorite	XX Heavy	17.3	9.51	390	450	" 20	.367	2052	609	79
116	Conoco	Medium Motor	24.8	9.05	415	480	" 20	.491	420	186	56
117	Conoco	Medium Heavy	23.7	9.12	420	480	" 20	.929	670	279	66
118	Conoco	Heavy	23.6	9.12	430	490	" 20	.990	...	315	70
808	Conoco	Heavy Motor	23.8	9.11	425	490	" 20	1.05	...	...	74
828	Conoco	Heavy Motor	24.0	9.10	425	490	" 20	.909	...	...	73
119	Conoco	Special Heavy	23.2	9.15	440	515	" 20	1.371	...	507	90
120	Conoco	Extra Heavy	22.5	9.19	490	580	" 20	1.681	...	905	129
829	Conoco	Extra Heavy	23.0	9.16	485	575	" 20	1.81	...	...	126
121	Castrol	C.W.	24.0	9.10	405	455	20	.177	...	203	58
122	Castrol	A.A.	25.1	9.03	415	475	30	.696	...	268	66
866	Castrol	A.A.	25.4	9.02	415	475	30	.763	...	272	68
123	Castrol	S.C.	24.1	9.09	420	485	25	.994	...	338	75
124	Agricastrol	No. 1	23.6	9.12	410	470	25	1.026	...	310	71

O.C. No.	Brand	Grade	Density at 60° F.		Flash Point in deg. F.	Fire Point in deg. F.	Pour Point in deg. F.	Carbon residue in %	Visc. at 100° F.	Visc. at 130° F.	Visc. at 210° F.
			A.P.I.	lbs./gal.							
840	Castrol.....	No. 2.....	23.7	9.12	415	470	25	.698	....	...	71
125	Agricastrol.....	No. 2.....	23.6	9.12	420	480	30	1.042	...	367	77
126	Agricastrol.....	No. 3.....	24.8	9.05	460	520	45	1.207	....	456	90
127	Motorene.....	B.B.....	23.5	9.13	435	500	30	1.128	....	...	85
819	Motorene.....	B.B.....	23.3	9.14	440	495	40	2.18	....	...	87
128	Motorene.....	Super Heavy.....	21.5	9.25	460	545	45	3.385	....	...	143
843	Motorene.....	Super Heavy.....	21.4	9.26	445	510	35	3.38	....	...	134
130	John Munroe.....	No. 4.....	23.9	9.11	430	485	35	1.382	....	...	78
820	John Munroe.....	No. 44.....	23.8	9.11	425	485	35	1.60	....	...	77
129	John Munroe.....	Extra Heavy No. 44.....	22.9	9.17	460	525	45	1.902	....	...	114
821	John Munroe.....	No. 44.....	22.8	9.17	460	530	45	2.19	....	...	113
823	John Munroe.....	No. 44.....	22.9	9.17	460	530	40	2.02	....	233	116
132	Red Head.....	Motor Medium.....	22.7	9.18	405	470	Below 20	.172	....	...	58
818	Red Head.....	Medium Motor.....	20.7	9.30	415	475	"	.219	....	...	57
131	Red Head.....	Tractor D.....	22.2	9.21	415	480	"	.214	....	293	64
406	Red Head.....	Heavy Motor.....	22.1	9.21	425	495	"	.112	....	...	64
832	Red Head.....	Heavy Motor.....	22.5	9.19	425	495	"	.084	....	...	65
830	Red Head.....	Tractor Light.....	21.9	9.22	425	485	"	.224	....	...	75
403	Petroleum Products.....	Tractor D.....	21.7	9.24	440	525	"	1.053	....	501	88
404	Petroleum Products.....	Tractor C.....	22.0	9.22	465	540	"	1.304	....	647	104
407	Red Head.....	Tractor C.....	21.3	9.26	460	535	"	.365	....	...	101
801	Petroleum Products.....	Tractor C.....	21.2	9.27	475	555	"	.829	....	...	111
831	Red Head.....	Tractor Heavy.....	17.3	9.51	430	500	30	.380	....	...	110
848	Red Head.....	Tractor C.....	21.3	9.26	445	525	Below 20	.386	....	...	97
133	Maple Leaf.....	Heavy Motor.....	22.4	9.20	460	535	"	.663	....	515	87
844	Maple Leaf.....	Heavy.....	23.0	9.16	430	505	"	.325	....	...	63
135	Polarine.....	Heavy.....	23.7	9.12	420	495	30	.592	....	233	61
846	Polarine.....	.....	23.0	9.16	420	495	30	.450	....	...	61
136	Polarine.....	Special Heavy.....	22.7	9.18	445	525	30	.497	....	...	74
817	Polarine.....	Special Heavy.....	22.7	9.18	440	520	30	.538	....	...	73
822	Polarine.....	Special Heavy.....	22.7	9.18	440	520	30	.596	....	...	74
137	Regalube.....	Heavy Motor.....	24.3	9.08	415	485	Below 20	.943	....	...	71
834	Regalube.....	Heavy Motor.....	25.8	8.99	415	470	25	.821	....	...	63
863	Regalube.....	Heavy.....	25.3	9.02	435	495	Below 20	1.04	....	...	71
138	Regalube.....	Extra Heavy Tractor.....	20.0	9.34	385	475	"	1.179	....	...	101
833	Regalube.....	Extra Heavy Tractor.....	21.9	9.22	400	465	"	1.20	....	...	101

APPENDIX VI.

Hints on the Economical Use of Motor Fuels and Lubricating Oils.

Compiled by Oil Enquiry Committee of the Provincial
Government of Alberta.

These notes refer more particularly to tractor and other heavy engines.

1. In order to give effective lubrication the oil must reach the bearing surfaces in quantity sufficient to maintain a film of oil between these surfaces.

2. Difficulty in starting an engine, with consequent excessive cranking and choking, results in the washing of the walls of the cylinders free from lubricating oil and damage may thus be caused. The operator is advised to learn how to start his engine quickly.

3. In cold weather the use of hot water in the cooling system makes for ease in starting.

4. It is probable that much damage is done to the engine through the use of too heavy an oil. On cold mornings such an oil is practically solid and the engine may be run for some considerable time before the oil becomes thin enough to circulate and thus reach the bearing surfaces.

Under such conditions a lighter oil is much preferable.

5. Dilution of crank case oil by unburned residues from the fuel does not appear to be as injurious as is commonly supposed. To insure oil reaching the bearings some operators mix even the lightest of lubricating oil with a percentage of kerosene.

6. A recommended practice is to add one pint of lubricating oil to every five gallons of the gasoline to insure some lubrication in the cylinders, if for any reason the oil circulation should fail at any time. Particularly is this advisable when a new tractor is being "run in."

Thick oils should be thinned with some gasoline before mixing with the bulk. This prevents the oil from sinking to the bottom of the gasoline tank and choking the feed pipe. Once the oil is thoroughly mixed with the gasoline it will never separate.

7. Many authorities believe that oil never, or only very slowly, wears out, and that if filtered to remove dust and grit it may be used over and over again with satisfactory results.

For this purpose a suitable filter may be made from an oil drum with the top cut off. Three layers of closely woven flannel should be wired over the open end so as to form a bag into which the used oil may be poured. A cock by means of which the filtered oil may be drawn off should be fitted about two inches above the bottom of the drum, and a cleaning plug to facilitate the occasional removal of water and sediment should be fitted in the bottom.

To use the filter, the oil should be drained from the crankcase as soon as the day's run is completed and while still hot should be poured into the filter and allowed to drain through. In cold weather it would be well to keep the filter in a warm place, otherwise the oil may congeal before it drains through.

The cleaned oil may then be drawn off for use next morning, the loss in volume being made up by addition of new oil.

The flannels must be removed from time to time and washed clean with gasoline. This should be done when the filtering becomes too slow.

8. Whether or not this filtering is done, it is advisable during cold weather to drain off the oil each evening and to heat it just before replacing in the tractor in the morning.

9. Much of the wear that occurs in the tractor engine is due to dust and grit which enter the mechanism with the air supply. This condition can be improved by adequate filtering of both the air supply and the circulating oil.

The air filter and the oil filter should be frequently cleaned. With heavy use on dusty roads or fields daily cleaning may be advisable.

10. Excessive consumption of lubricating oil is caused by improper fitting pistons and rings. It pays to keep the engine in good mechanical condition.

11. The use of too thin or too diluted an oil may also cause excessive consumption of oil. Every operator is recommended to ascertain the S.A.E. number of the oil suitable for the engine when new and when somewhat worn, as well as for summer and for winter use. All oil should then be purchased by S.A.E. number.

12. Whilst it does not seem possible to state definitely the lubricating value of different oils, an operator having found an oil which gives satisfaction under his particular conditions, and with his particular engine, is well advised to continue the purchase of such a brand or grade. The use of a brand of oil which does not maintain uniform quality is to be avoided.

13. Trouble with water in gasoline and kerosene is apparently caused by improper storage by the consumer permitting the introduction of rain water. Empty drums should always be turned upside down before refilling. The plugs on oil drums should always be screwed down tightly. Some drums are constructed so that the rim is higher than the filling hole. A hole can be drilled through the base of the rim to ensure that rainwater drains off.

14. Economy in running a tractor or other heavy engine can frequently be attained by using as fuel a mixture of equal volumes of gasoline and kerosene. These substances have approximately the same heat value per pound, but as kerosene is the heavier, a gallon of kerosene has a greater heat value than a gallon of gasoline. Such a mixture should only be used if the carburettor can be adjusted to burn the mixture efficiently. Such a blend gives easier running than kerosene alone, but it is advisable to start the engine on straight gasoline. This can be done by priming the cylinders with gasoline or by having a small fuel tank of gasoline and then switching over to the mixture in the main tank as soon as the engine is started.

15. During cold weather it is advisable to fit the engine with a radiator cover and with the aid of a motometer, to keep the temperature of the cooling water between 160 and 180°F. This temperature range is for a mixture of gasoline and kerosene as in 14.

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